REGION V

ADMIN. 1000A (REV. 8/76)

STATE OF MINNESOTA

Office Memorandum

DEPARTMENT Health

DATE: 9/2/81

TO : Jim Pankanin (5E-WHME)
U.S. Environmental Protection Agency
Water & Hazardous Materials Enforcement
230 S. Dearborn Street
Chicago, Illinois 60604

FROM : Mike Conroy

PHONE: 612-296-5297

SUBJECT: Hickok Reports 618-25 and 618-8.

I am forwarding to you copies of Hickok reports on the Disposition of g.c. well Discharge and on the g.c. well Quality Projections. Please return any comments to me by Friday - 3p.m. - ~~Aug~~ September 11, 1981.

called in comments 9/14/81

JP

545 Indian Mound
Wayzata, Minnesota 55391
(612) 473-4224

September 2, 1981

Mr. Michael Convrey
Minnesota Department of Health
717 SE Delaware Street
Minneapolis, Minnesota 55440

Re: St. Louis Park Groundwater Contamination Study

Dear Mike:

Transmitted herewith are two memorandums for the referenced project, Number G18-5 entitled "Alternatives for Ultimate Disposition of Gradient Control Well Discharge" and Number G18-8 entitled "Gradient Control Well Quality Projections".

Respectfully submitted,

EUGENE A. HICKOK AND ASSOCIATES

E. A. Hickok, P.E.

bt

Enclosures

cc: Richard Ferguson, MPCA
Marc Hult, U.S.G.S.

NON-RESPONSIVE

G18-5

SEPTEMBER 2, 1981

ST. LOUIS PARK GROUNDWATER CONTAMINATION STUDY
ALTERNATIVES FOR ULTIMATE DISPOSITION OF
GRADIENT CONTROL WELL DISCHARGE

THIS MEMORANDUM IDENTIFIES AND ANALYZES POSSIBLE ALTERNATIVES FOR THE ULTIMATE DISPOSITION OF EFFLUENT FROM GRADIENT CONTROL WELLS WHICH MAY BE IMPLEMENTED TO REMEDY GROUNDWATER CONTAMINATION IN THE ST. LOUIS PARK VICINITY. IT IS FEASIBLE WITH THE BEST TECHNOLOGY TO TREAT THE EFFLUENT TO MEET PROPOSED POTABLE WATER CRITERIA FOR POLYNUCLEAR AROMATIC HYDROCARBONS (PAH), AND USE THE WATER FOR MUNICIPAL SUPPLY. DISPOSAL TO SANITARY SEWERS OR TO THE MISSISSIPPI RIVER DIRECTLY (VIA FORCE MAIN TO STORM DRAINS IN MINNEAPOLIS) IS FEASIBLE. DEPENDING ON THE SURFACE WATER CRITERIA ASSUMED FOR PAH, TREATMENT REQUIREMENTS FOR THIS WOULD VARY FROM THOSE COMPARABLE TO TREATMENT FOR MUNICIPAL WATER SUPPLY TO NO TREATMENT. THE FEASIBILITY OF DISPOSAL TO THE MINNEAPOLIS CHAIN OF LAKES OR TO MINNEHAHA CREEK WOULD DEPEND ON THE SURFACE WATER CRITERIA ASSUMED FOR PAH. EFFLUENT FROM A DRIFT "PUMPOUT" WELL IN THE AREA OF WORST CONTAMINATION COULD NOT BE DISCHARGED TO SURFACE WATERS IN THE REGION UNDER ANY OF THE CRITERIA CONSIDERED, AND WOULD REQUIRE OTHER MEANS OF DISPOSAL. THIS MEMORANDUM REPRESENTS COMPLETION OF TASK 4040 OF THE REFERENCED PROJECT.

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ALTERNATIVES FOR ULTIMATE DISPOSITION OF GRADIENT CONTROL WELL DISCHARGE

A. INTRODUCTION

This memorandum identifies alternatives for the ultimate disposition of water discharged from gradient control wells which may be implemented to remedy groundwater contamination in St. Louis Park. Polynuclear aromatic hydrocarbons (PAH) are the contaminants of primary concern. Gradient control wells are being considered for the Middle Drift, Platteville, St. Peter, Prairie du Chien-Jordan and Mt. Simon-Hinckley aquifers, and for purposes of contaminant "pumpout" in the most severely contaminated portion of the drift.

In this study, criteria have been proposed for acceptable PAH levels in water. The criteria proposed for potable water are 2.8 ng/l for each carcinogenic PAH and 28.0 ng/l for each PAH not known to be cancer-causing. Various criteria have been considered for surface waters and discharge into surface waters.

The most stringent surface water criteria were based on a high rate of fish consumption from the Mississippi River (one pound per capita daily), assumed for a critical population group in the Twin Cities (the Hmong). This resulted in a limit of 0.018 ng/l for each carcinogenic PAH in the Mississippi River; consistent with later discussions, a corresponding limit of 0.18 ng/l for each PAH not known to be carcinogenic is also appropriate. If these strict criteria were adopted for the Mississippi River, it would not be inconsistent to apply them also to Minnehaha Creek and other local surface waters. Note that these criteria are extremely conservative and probably are exceeded in the Mississippi River at present.

Another set of criteria is based on meeting the potable water criteria in any surface receiving water. This is less restrictive than the first criteria but is still conservative.

Two further criteria come directly from the U.S. Environmental Protection Agency criteria document for PAH (October, 1980); they are 31.1 and 311 ng/l for "total" PAH, corresponding to risk levels of one in 1,000,000 and one in 100,000 respectively. The Minnesota Pollution Control Agency suggests that these criteria be investigated, and that they be interpreted as applying to the sum of detectable concentrations only. That is, all concentrations reported "below detection limits" would be assumed to be zero for purposes of summing the "total" PAH.

In summary, four surface water criteria are considered here, as shown below in Table 1.

Table 1
Possible Surface Water Criteria for PAH

	PAH Limits (ng/l)
1. Fish Intake Criteria	
Each Carcinogenic PAH	0.018
Each "Other" PAH	0.18
2. Potable Criteria	
Each Carcinogenic PAH	2.8
Each "Other" PAH	28.0
3. EPA Criterion (10^{-6} risk)	
"Total" PAH	31.1
4. EPA Criterion (10^{-5} risk)	
"Total" PAH	311.

Dilution would be allowed for in the Mississippi River but not in the Minnehaha Creek Watershed. Therefore, any discharge to Minnehaha Creek (which is an intermittent stream) or its tributaries - which include the Minneapolis Chain of Lakes - would need to meet the surface water criteria in the effluent.

Dilution in the Mississippi River is based on 7-day, 10-year low flows projected by the Minnesota Pollution Control Agency (MPCA) for the year 2000. The projected low flows are 1,138 cubic feet per second (cfs) in Minneapolis (Lock and Dam No. 1) and 1,633 cfs in St. Paul (Robert Street). The greater flow in St. Paul is due to the Minnesota River inflow. Wells discharged into sanitary sewers would ultimately reach the Mississippi River via the Metropolitan Wastewater Treatment Plant at Pig's Eye. A June, 1981 report by the MPCA, "Mississippi River Wasteload Allocation Study", shows a plant flow at Pig's Eye of 175 million gallons daily (271 cfs) for a flowrate exceeded 70 percent of the time during summer. At the MPCA's suggestion, this flow is used with the cited Mississippi low flow in St. Paul, to yield a total estimated low flow at Pig's Eye of 1,904 cfs.

1633
271
1904

The approach followed here is to compute "allowable loadings" of PAH from the above flowrates and criteria, ignoring the small additional flow which may result from gradient control wells. The allowable loadings are then fully allocated , if necessary, to the possible gradient control well discharge. These simplifications are made to facilitate the screening of alternatives. The allowable loadings corresponding to the four criteria are shown in Table 2.

Table 2

Allowable Loadings of PAH (grams/day) for Various Criteria

	Mississippi River Location	
	Minneapolis	Pig's Eye
1. Fish Intake Criteria		
Each Carcinogenic PAH	0.050	0.084
Each "Other" PAH	0.50	0.84
2. Potable Criteria		
Each Carcinogenic PAH	7.8	13.
Each "Other" PAH	78.	130.
3. EPA Criterion (10^{-6} risk)		
"Total" PAH	86.5	145
4. EPA Criterion (10^{-5} risk)		
"Total" PAH	865.	1,450.

The projected quantity and quality of gradient control well discharge have been estimated in separate memorandums. Table 3 summarizes this information.

Table 3

Characteristics of Gradient Control Well Discharge

Wells(s)	Total Flow, cfs	PAH Load, grams/day (Average PAH Concentration, ng/l) Highest Carc.	Highest "Other"	"Total" PAH
Pumpout Well in Drift-W13	0.022	16,000 (0.3×10^9)	33,000 (0.6×10^9)	160,000 (3.0×10^9)
All Other Wells Plan 1 in PdC-J	12	1.6 (54.)	81. (2,700)	115. (3,800)
All Other Wells Plan 2 in PdC-J	11	1.5 (56.)	60. (2,300)	79. (3,000)

Note: Plan 1 in Prairie du Chien-Jordan uses Old #1 (Well W112), and Plan 2 instead uses a proposed new well (RW1).

In Table 3, Plan 1 is assumed for the Mt. Simon-Hinckley aquifer, and the quality for a pumpout well in the drift is assumed to be that of monitoring Well W13, which the U.S. Geological Survey has recently analyzed.

This memorandum defines the alternatives for ultimate disposition, discusses the feasibility of each, and classifies the alternatives in regard to the need for treatment. The final section includes a summary and conclusions.

B. DEFINITION OF ALTERNATIVES

Effluent from gradient control wells could be discharged into locally or regionally draining surface waters, or used for beneficial purposes. The specific alternatives considered here are:

1. Municipal Water Supply
2. Sanitary Sewer
3. Mississippi River
4. Minneapolis Chain of Lakes
5. Minnehaha Creek

Using the well discharge for municipal water supply arises as a natural idea because several municipal wells have been closed due to PAH contamination, and the City of St. Louis Park has investigated treatment methods aimed at putting closed wells back into use. New or modified treatment facilities would generally be required for this alternative.

Discharging gradient control well effluent into sanitary sewers in St. Louis Park ultimately results in discharge to the Mississippi River. The Mississippi provides the greatest dilution available in the Twin Cities area because it is the regional drainageway for surface waters and for groundwater aquifers including the Prairie du Chien-Jordan.

Discharge to the Mississippi River could also be done via storm sewers in Minneapolis. This would require pumping the well effluent some distance through force mains in order to connect with major storm drains in Minneapolis. In addition, local storm sewers in the St. Louis Park vicinity are tributary to the Minneapolis Chain of Lakes or to Minnehaha Creek directly.

It should be noted that existing industrial and commercial use of contaminated groundwater in the area is beneficial from the viewpoint of gradient control. Such water use could be part of an overall gradient control scheme. To this end, the State of Minnesota might appropriately give special consideration to the ultimate disposal of such water. The present memorandum, however, considers only new gradient control wells.

C. FEASIBILITY OF ALTERNATIVES

1. Municipal Water Supply

Water discharged from gradient control wells could be used by the City of St. Louis Park to supplement their groundwater supply. The discontinued use of Wells 4, 5, 7, 9, 10 and 15

has reduced the City well capacity by approximately 30%. Therefore, the use of gradient control wells for municipal purposes would be helpful in meeting St. Louis Park water demands.

The use of one or more of the presently contaminated City wells as gradient control wells would eliminate the need to construct new wells. All of the contaminated wells are in the Prairie du Chien-Jordan formation. There are other City wells in the Mt. Simon-Hinckley and the St. Peter aquifers, as well as uncontaminated wells in the Prairie du Chien-Jordan.

Wells used for gradient control in the Platteville and drift or for contaminant pumpout would not provide sufficient supply to be of benefit to the City because of their small discharge rates.

Gradient control wells constructed in the St. Peter and Prairie du Chien-Jordan formations could be used for potable purposes and would be of benefit to the City of St. Louis Park. The location of the proposed gradient control wells will have a bearing on whether or not existing City wells may be utilized.

2. Sanitary Sewer

Effluent from contaminated gradient control wells could be discharged directly into the existing sanitary sewer system provided adequate sewer capacity is available.

Two major trunk sewers serve the City. One trunk line basically serves the northern third of the City in an area generally north of the Burlington Northern Railroad. This trunk runs from west to east and discharges into the City of Minneapolis system in the vicinity of France Avenue and the Burlington Northern Railroad.

Another major trunk sewer serves the remaining portion of St. Louis Park and runs in a general west to east direction. This trunk follows Wooddale Avenue southeast to 40th Street and northeast to the corner of France Avenue and West 39th Street. At this point the trunk discharges into the City of Minneapolis system.

The location of the gradient control wells and further study of the trunk sewer capacities are required to determine if the conveyance facilities to the point of discharge are adequate. adequate capacity has not been determined

3. Mississippi River

Gradient control wells could be discharged directly to the Mississippi River. Several discharge points are possible via a force main to existing storm sewers serving the City of Minneapolis. Without a detailed study it appears that a force main could be constructed along the Burlington Northern Railroad right-of-way eastward into the City of Minneapolis to any one of several large storm sewers which discharge to the Mississippi River.

Another possible route is a force main along the Chicago, Milwaukee, St. Paul and Pacific Railroad right-of-way eastward into the City of Minneapolis to a large storm sewer which also discharges into the Mississippi River.

A preliminary study of this alternative indicates that it may be far more costly than the other alternatives because of the force main conveyance system required.

4. Minneapolis Chain of Lakes

Discharge of gradient control wells to the Minneapolis Chain of Lakes system is feasible at several points. There are seven (7) major storm sewers which presently originate in St. Louis Park and discharge into the Minneapolis Chain of Lakes system. From north to south, these storm sewers are located as follows:

- A 72" north of the Burlington Northern Railroad discharging into Brownie Lake
- A 42" on Cedarwoods Road discharging into Lake of the Isles
- A 21" on West 27th Street discharging into Lake of the Isles
- A 24" on West 31st Street (County Ditch 29) discharging into Lake Calhoun
- A 36" on West 35th Street (County Ditch 14) discharging into Lake Calhoun
- A 42" on West 39th Street discharging into Lake Calhoun
- A 30" on West 40th Street discharging into Lake Calhoun

The location of the gradient control wells will determine the extent and type of conveyance system required. Many alternatives are available by virtue of the existing storm sewers which presently discharge into the Minneapolis Chain of Lakes.

5. Minnehaha Creek

Water pumped from gradient control wells could be discharged into Minnehaha Creek, either directly or via existing storm sewers serving St. Louis Park which discharge into the Creek.

There are several storm sewers which presently discharge into Minnehaha Creek that could be utilized depending on the location of the gradient control wells. If the control wells are located near an existing storm sewer system which discharges into the Creek, then a minimum of force main would be required.

The major storm sewers discharging into the Creek are located in the southern portion of the City of St. Louis Park. Therefore, a fairly extensive conveyance system would be required if the gradient control wells were not located in the southern part of the City .

From a hydraulic standpoint, a drift "pumpout" well could be discharged into Minnehaha Creek because of its close proximity to the Creek and the existing storm sewer system which originates in the old creosote site. This system consists of a series of retention ponds and pipe flowing in a southerly direction and discharges into the Creek in the vicinity of the City garage on Meadowbrook Lane.

D. TREATMENT NEEDS

The treatment needs for each alternative can be found by comparing the well discharge quality with the criteria discussed in Section A. From this comparison, the percent PAH removal required for each alternative can be estimated.

Table 4 - Treatment Requirements for Gradient Control Wells - Plan 1, and Table 5 - Treatment Requirements for Gradient Control Wells - Plan 2, give the estimated removal percentages. (Plans 1 and 2 refer to gradient control well options for the Prairie du Chien-Jordan aquifer.) These results will be discussed in the following paragraphs.

In addition, for a pumpout well in the most contaminated portion of the drift, similar results appear in Table 6 - Treatment Requirements for Pumpout Well in Drift. The results in Table 6 show that none of the disposal alternatives considered is feasible for a drift pumpout well under any of the possible PAH criteria. Therefore, if a drift pumpout well were to be implemented (in the most contaminated zone), it would require some other means of disposal, perhaps entailing transport by rail or tank truck.

The paragraphs below discuss gradient control wells excluding a pumpout well in the drift.

1. Municipal Water Supply

Tables 4 and 5 indicate that gradient control well effluent could, with the best technology available, be treated for municipal water supply use. The estimated treatment requirements are 95 percent PAH removal for carcinogenic compounds and 99 percent for "other" PAH. These percentages are based on the total discharge from all wells - again, except for a drift pumpout well. Treatment requirements would of course vary from well to well.

2. Sanitary Sewer

Gradient control wells could be discharged without treatment to sanitary sewers under criteria 2-4. With the fish intake criteria, however, a high degree of treatment would be required. In fact, to meet these criteria the PAH removal percentages would need to be similar to those required for municipal water supply (i.e., 94 to 99 percent).

does this address PAH removal in SLP POTW ? assume no removal in POTW 3

3. Mississippi River

Gradient control wells could also be discharged directly to the Mississippi River via storm drains in Minneapolis. There would be minimal or no treatment requirements under criteria 2-4. (With Plan 1 in the Prairie du Chien-Jordan, the potable criteria and the stricter EPA criterion would require some treatment - 4 to 25 percent removal - but in other cases no treatment would be required.) However, the fish intake criteria imply more stringent treatment requirements than for municipal water supply.

unclear 4

4. Minneapolis Chain of Lakes

The effluent PAH criteria for this disposal alternative equal the corresponding surface water criteria, because no allowance for dilution is made. The fish intake criteria are too stringent to be met by any known treatment technology. The potable criteria are feasible to meet, as previously discussed. The two EPA criteria imply treatment requirements roughly comparable to those for potable use (99 percent removal for the stricter criterion and 90 to 92 percent for the other). In this disposal alternative the treatment requirements depend strongly on the surface water PAH criteria adopted.

5. Minnehaha Creek

The treatment requirements for this alternative are exactly as for the Minneapolis Chain of Lakes alternative.

E. SUMMARY AND CONCLUSIONS

The following conclusions assume that existing data adequately define groundwater concentrations of PAH, and that 100 percent of allowable PAH loadings in the Mississippi River could be allocated to gradient control well discharge. assumes zero background in Mississippi.

1. Gradient control well discharge can, with the best technology available, be treated and used for municipal water supply.

2. Gradient control wells can be discharged to sanitary sewers or to the Mississippi River directly (via force main to storm sewers in Minneapolis) with minimal or no treatment required - unless the fish intake criteria applied, in which case treatment requirements would be similar to those for municipal water supply.

3. Gradient control wells can be discharged to the Minneapolis Chain of Lakes or to Minnehaha Creek with treatment requirements similar to those for municipal water supply - unless the fish intake criteria applied, in which case these alternatives would not be feasible due to unattainably high treatment requirements.

4. Disposal of pumpout well effluent from the most contaminated portion of the drift is not feasible by any of the alternatives considered.

TABLE 4

Treatment Requirements for Gradient Control Wells - Plan 1*

Alternative	PERCENT PAH REMOVAL REQUIRED					
	1. Fish Intake Criteria		2. Potable Criteria		3. EPA Criterion (10^{-6} risk)	4. EPA Criterion (10^{-5} risk)
	Carcin.	Other PAH	Carcin.	Other PAH	"Total" PAH	"Total" PAH
1. Municipal Water Supply	--	--	95	99	--	--
2. Sanitary Sewer	95	99	0	0	0	0
3. Mississippi River	97	99	0	4	25	0
4. Minneapolis Chain of Lakes	100	100	95	99	99	92
5. Minnehaha Creek	100	100	95	99	99	92

* All wells, excluding pumpout well in drift; Plan 1 refers to option for Prairie du Chien-Jordan aquifer.

Note: Value 100 means >99.5; value zero means no treatment required.

TABLE 5
Treatment Requirements for Gradient Control Wells - Plan 2*

Alternative	PERCENT PAH REMOVAL REQUIRED					
	1. Fish Intake Criteria		2. Potable Criteria		3. EPA Criterion (10^{-6} risk)	4. EPA Criterion (10^{-5} risk)
	Carcin.	Other PAH	Carcin.	Other PAH	"Total" PAH	"Total" PAH
1. Municipal Water Supply	--	--	95	99	--	--
2. Sanitary Sewer	94	99	0	0	0	0
3. Mississippi River	97	99	0	0	0	0
4. Minneapolis Chain of Lakes	100	100	95	99	99	90
5. Minnehaha Creek	100	100	95	99	99	90

* All wells, excluding pumpout well in drift; Plan 2 refers to option for Prairie du Chien-Jordan aquifer.

Note: Value 100 means >99.5; value zero means no treatment required.

TABLE 6
Treatment Requirements for Pumpout Well in Drift

Alternative	PERCENT PAH REMOVAL REQUIRED					
	1. Fish Intake Criteria		2. Potable Criteria		3. EPA Criterion (10^{-6} risk)	4. EPA Criterion (10^{-5} risk)
	Carcin.	Other PAH	Carcin.	Other PAH	"Total" PAH	"Total" PAH
1. Municipal Water Supply	--	--	100	100	--	--
2. Sanitary Sewer	100	100	100	100	100	99
3. Mississippi River	100	100	100	100	100	99
4. Minneapolis Chain of Lakes	100	100	100	100	100	100
5. Minnehaha Creek	100	100	100	100	100	100

Note: Value 100 means >99.5

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G18-8

AUGUST 31, 1981

ST. LOUIS PARK GROUNDWATER CONTAMINATION STUDY - GRADIENT CONTROL WELL QUALITY PROJECTIONS

THIS MEMORANDUM PRESENTS QUALITY PROJECTIONS IN TERMS OF POLYNUCLEAR AROMATIC HYDROCARBON (PAH) CONCENTRATIONS FOR GRADIENT CONTROL WELLS PROPOSED IN ST. LOUIS PARK. FOR THE VARIOUS WELLS, INITIAL 20-YEAR AVERAGE CONCENTRATIONS RANGE FROM 3 TO 300 NG/L FOR CARCINOGENIC PAH, 50 TO 9,000 NG/L FOR "OTHER" PAH, AND 80 TO 10,000 NG/L FOR "TOTAL" PAH. THIS MEMORANDUM REPRESENTS COMPLETION OF TASK 2050 OF THE REFERENCED PROJECT.

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GRADIENT CONTROL WELL QUALITY PROJECTIONS

This memorandum presents quality projections for gradient control wells proposed in St. Louis Park as described in a separate memorandum entitled, "Summary of Gradient Control Well Discharge Quantities" (No. G18-6, August 21, 1981, by E. A. Hickok and Associates). Well discharge quality is defined in terms of polynuclear aromatic hydrocarbon (PAH) concentrations. The quality projections are for an initial 20-year period of operation, as this is a reasonable planning period for any treatment facilities which may be required.

The major assumptions of the present analysis are (1) ground water quality monitored in a given well is representative of a zone surrounding the well, (2) sorption of PAH is significant in the Middle Drift aquifer but not in the bedrock aquifers, and (3) leakage of contaminants through confining beds does not significantly affect the 20-year quality projections. Details concerning the sorption and leakage assumptions will be presented in the final gradient control well memorandum under task 2120.

The procedure used in making the projects entailed the following steps: (1) define the most recent quality of all monitored wells in all aquifers, in terms of "total" PAH, highest carcinogenic PAH and highest "other" PAH, (2) construct Thiessen polygons for each aquifer, based on all monitored wells, (3) construct time-interval "capture zones" for each possible gradient control well, based on pumping rates and hydrogeologic parameters, with coordinates computed by equations consistent with the predicted overall capture boundaries, (4) determine weighting factors for each time-interval and each recovery well based on overlaying the time-interval "capture zones" on the Thiessen polygons and (5) compute predicted future quality of each possible gradient control well, for each time-interval, from the weighting factors and the recent quality of monitored wells. Initial 20-year averages were then computed from these results.

Table 1 - Gradient Control Well Discharge Quality Projected 20-Year Averages, shows the projections. For the various wells, the projected PAH concentrations range from 3 to 300 ng/l for carcinogenic PAH, 50 to 9,000 ng/l for "other" PAH and 80 to 10,000 ng/l for "total" PAH. The concentrations in Table 1 will be the basis for evaluating treatment and ultimate disposal of gradient control well discharge in other memorandums.

TABLE 1

Gradient Control Well Discharge Quality
Projected 20-Year Averages

Aquifer	Plan	Well	PAH Concentrations (ng/l) Highest Carc.	Highest "Other"	"Total" PAH
Mt. Simon-Hinckley	1	SLP 11†	3.	50.	80.
	2	R-W23*	?	?	?
		R-W38*	300	4,000	7,000
	3	RW2*	?	?	?
Prairie du Chien-Jordan	1	SLP 10,15	200	9,000	10,000
		W70	30.	2,000	4,000
		SLP 4	5.	200	300
		W112	30.	3,000	5,000
	2	SLP 10,15	200	9,000	10,000
		W70	30.	2,000	4,000
		SLP 4	5.	200	300
		RW1*	20.	800	1,000
St. Peter	1	RW3*	30.	200	500
Platteville	1	RW4*	9.	2,000	2,000
		RW5*	70.	3,000	5,000
		W100‡	30.	2,000	3,000
Middle Drift	1	RW6*	200	1,000	2,000
		RW7*	100	400	1,000
		W2‡	200	50.	400

† SLP denotes St. Louis Park municipal well.
* Proposed new well.
‡ Estimated initial quality.